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# William Crawford Gorgas

## He Set the Standard of Military Preventive Medicine

Colonel Thomas M. Cashman MD\*

*William C. Gorgas spent the first twenty years of his career dedicated to the daily tasks of rural patient care. When assigned to Havana, his practicable application of Walter Reed's demonstration of Yellow Fever transmission resulted in the elimination of Yellow Fever within eight months. His perseverance in applying principles of arthropod born disease control allowed the completion of the Panama Canal. He developed the Sanitation Corps, presently Army Environmental Health Services, and initiated emphasis on preventive medicine for the soldier. He served as the Surgeon General of the Army during World War I, when for the first time in our history fewer soldiers died from disease than from combat casualties.*

*"The success of any system of sanitation ... will depend a great deal upon the choice of the man who has charge of carrying it into execution. If he believes in it, has tact, is enthusiastic and persevering, it will succeed. If he is discouraged by difficulties and opposition he will fail, even if his system is correct."*

Thus, William Crawford Gorgas, whose achievements in infectious disease control allowed the completion of the Panama Canal, summarized his own approach to attain his professional goals. The genius of this man, the prototype for U.S. Army Preventive Medicine Officers and who initiated the Army Sanitation Corps, was his ability to persevere, to be open to the ideas of others, and to make practical use of them.

William C. Gorgas was born on October 3, 1854, near Mobile, Alabama the son of a U.S. Army Ordnance Officer. His family lived in Charleston, South Carolina, when the Confederates fired upon Ft. Sumpter. His father Josiah, a Pennsylvanian married to an Alabama woman, accepted a commission as a Brigadier General of Ordnance in the Confederate Army.

Young William Gorgas lived in Richmond, Virginia, during the Civil War. There he met Jefferson Davis, Robert E. Lee and Thomas "Stonewall" Jackson in the front parlor of his home when they came to confer with his father. Staunchly Confederate, he went barefoot during the last winter of the war in empathy with the ragged Southern Soldiers. He remained loyal to the South throughout his adult life and as a Federal Officer serving in Cuba, still argued that if the South had won secession, it would have eventually abolished slavery. His mother, deeply religious with a strong personality, remained a lifelong influence on him. Her keen sense of humor and zest for telling tales was apparent in Dr Gorgas who was an entertaining conservationist and often related his favorite stories, many about the Pirates of Panama.

Growing up, young William was hot-tempered, an indifferent student and a good athlete. During his military career he did a remarkable job controlling that temper. From early on he expressed an interest in the military, but his father actively discouraged this ambition. Nevertheless, he applied to West Point. President Grant's regime would not appoint the son of one who rose to the rank of Lieutenant General of Ordnance of the Confederacy and whose skills and dedication had prolonged the Civil War. William studied at The University of the South in Swanee, Tennessee, and as a student experienced his first encounter with Yellow Fever. He served as a volunteer in a New Orleans epidemic, and two of the four volunteers from his university died of this disease. Returning to school, he turned to his surviving friend and said, "Matt, I am going to try to find something that will drive this terrible thing from the earth."

Gorgas completed his studies in Swanee and, on his father's advice, studied law in New Orleans. After one year he discontinued his law studies. Still aspiring to the military, he studied medicine at Bellevue Medical College in New York City, and planned to make a career in military medicine. At Bellevue, he was a student of Dr William Welch, who in later years, as Dean of Johns Hopkins Medical College, strongly supported Gorgas as the Chief Sanitation Office of the Panama Canal Zone. While a medical student, he volunteered to help in a Yellow Fever epidemic in Memphis, Tennessee, but could not go because he lacked immunity to the disease. He completed his internship at Bellevue in June of 1880 and, in spite of his father's objections, accepted a commission as a First Lieutenant in the U.S. Army Medical Corps.

For the next twenty years, Dr Gorgas practiced inconspicuously at various isolated posts in Texas, North Dakota, and Florida. He was congenial and enjoyed an active social life. His cheerful bedside manner was a consistent quality in his practice. He was a dedicated physician and on two occasions almost froze to death, riding out in the North Dakota winter to attend the birth of Sioux infants. Against

\*Tripler Army Medical Center  
Department of Preventive Medicine Service  
1 Jarrett White Road  
Tripler AMC, Hawaii 96859-5000

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orders because he was not immune, he attended Yellow Fever patients and eventually contracted the disease. However, because of his subsequent immunity, he then received further assignments to care for Yellow Fever patients. One of these patients was Marie Doughty, whom he later married. Because of his interest and work with Yellow Fever he came in contact with Dr Josiah Nott, who coincidentally was the physician who attended his own birth. Dr Nott had published an article in *The New Orleans Medical and Surgical Journal* stating that malaria and Yellow Fever were transmitted by insects, possibly mosquitoes. However Dr Nott failed to convince Gorgas of his theory.

In 1901 the Army ordered MAJ William Gorgas to special duty in Havana to serve Yellow Fever Patients. While there Gorgas cared for Dr Victor Vaughan, stricken with the disease. Gorgas greatly impressed Dr Vaughan with his skills as a physician. Dr Vaughan, who became President of the American Medical Association, became an important ally to Gorgas during the Panama Canal Project. In Havana, Gorgas at first held to the miasma (filth) theory of Yellow Fever transmission and took steps to clean up the city. The incidence of Small Pox, Typhoid, and Dysentery decreased and the death rate in Havana dropped below that of several European cities. However, the incidence of Yellow Fever increased.

Gorgas became friends with Dr Carlos Finlay, who developed the theory that the Stergomyia mosquito (*Aedes aegypti*) transmitted Yellow Fever. Because of this theory, many fellow professionals considered Finlay to be a crackpot. Gorgas himself did not accept this theory either but remained respectful of Dr Finlay. Dr Henry R. Carter of the U.S. Public Health Service was convinced that Finlay's theory was correct. He had observed an epidemic in Mississippi and noted that Yellow Fever patients could be visited without hazard within the first ten to twelve days after the patients had become ill. Beyond that time, even if the patient had died, visitors were in mortal danger. Carter concluded there was a period of "intrinsic incubation." He attempted to publish his findings and contribute further to Finlay's theory. He concluded that transmission by Stergomyia required a 10 to 14 day incubation period in that mosquito after it had taken a blood meal from the Yellow Fever victim. The Journal of the American Medical Association; *JAMA* initially rejected his paper because it was too long. Publication of these findings were delayed two years.

Army Surgeon General Sternberg, doubting another popular theory of the time that Yellow Fever was due to a yet unproved "bacillus icteroides," dispatched the Walter Reed Commission to Havana. Walter Reed demonstrated transmission of Yellow Fever by the Stergomyia mosquito, and Gorgas took great care to credit Finlay with his important deductions, singling out the correct mosquito from over 800 species. Having observed a difference of virulence in Yellow Fever between summer and winter, Gorgas preserved a winter mosquito to infect patients as an immunization method. However, after several deaths, he deemed this approach too dangerous. Gorgas although not totally convinced that the mosquito was solely responsible for Yellow Fever transmission, decided to attack the mosquito in an attempt to break the disease cycle. Walter Reed replied to him "it can't be done." Dr Gorgas studied the habits of the Stergomyia. He found it to be an urban dweller with a preference for fresh water. He established a clean-up campaign using fresh water larval traps and appointed district officers to scour the city for unprotected fresh water. He screened the windows of

hospitals and the homes of Yellow Fever patients. He put screens on catchment water barrels and fined violators who left unprotected water on their premises five dollars. If the violators cooperated and removed unprotected water, Gorgas returned the five dollars. The Cubans, who assumed that all bureaucrats were dishonest, were so enamored when Gorgas returned their five dollars that they continued to cooperate. This program was so successful that Havana has been free of Yellow Fever since late 1901. Gorgas' mosquito control program also greatly reduced malaria. There had been nothing comparable in medical history to this remarkable war on mosquitoes.

In 1902 the Army promoted Gorgas and summoned him to Washington, DC. President Roosevelt, on the advice of Dr William Welch, appointed him as the Chief of Sanitation of the Panama Canal Project and sent him to Europe and Egypt. Gorgas studied the French's failed attempt to complete the Panama Canal and their successful Suez Canal project. He found that twenty-five percent of the French work force died during the project and one third of the force missed work each day due to illness. More than 22,000 men died of infectious disease during the French attempt. This experience convinced Gorgas that for the Panama Canal project to be successful he must control Malaria and Yellow Fever. Gorgas understood that Malaria was the greater threat and caused the greatest loss of French lives. "... if we do not control malaria our mortality is going to be heavy." He decided to attack Yellow Fever first to avoid panic should an outbreak occur. He concluded that if twenty to thirty thousand men came to Panama, the annual death toll could reach three to four thousand. On completion of two years in Europe and Egypt, Roosevelt sent Gorgas to the Canal Zone as an advisor with no real authority, rather than appoint him to the Panama Canal Commission. The American Medical Association had strongly supported that Gorgas be appointed to the commission. Thus William C. Gorgas began his trial of perseverance. Courtly, affable, described by an American engineer as "a grand, quiet, lovable man," he was unequivocally devoted to duty and physically hardened from hardships of frontier duty. His imperturbable and sensitive manner hid a disciplined, tough minded personality of such perseverance that he was the only senior official to see the Panama project through from start to finish.

The Retired Admiral Walker, chairman of the Panama Canal Commission and an engineer, did not agree that mosquitoes transmitted Yellow Fever and Malaria. Walker was obsessed with the notion that corruption was the cause of the French failure and would not fund a number of projects. He ignored Gorgas' appeal for supplies and experienced personnel. As a result Gorgas arrived in Panama with Dr Henry Carter and five others with virtually no materiel. They found numerous Stergomyia and Anopheles mosquitoes in every building. They found larvae in earthenware jars holding drinking water, open cisterns, rain barrels, pockets of ground water, crockery rings surrounding plants and in the shallow pans of water under the floor posts hospital beds to prevent ants from getting into the beds. There were no window screens and the hospital staff, French doctors and Sisters of Charity, were all infected with malaria. After dark the hospital staff would wrap themselves in bandages soaked in citronella to protect themselves from the swarms of mosquitoes.

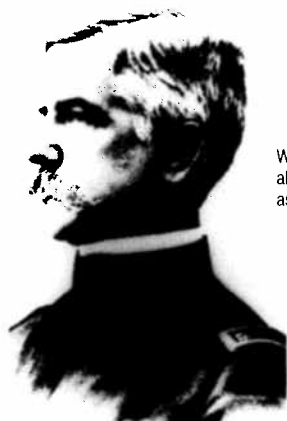
Gorgas considered the mosquito as the most deadly predator of Panama and intended to solve the problem by learning the biology



William Gorgas as the Army Surgeon General



General Gorgas talking with a patient  
on the grounds of Walter Reed Army Hospital



William Gorgas as a Major  
about the time of his  
assignment to Havana



William Gorgas viewing a mosquito breeding site in Panama

of the specific mosquitoes in order to destroy them. Walker publicly ridiculed Gorgas, would not support him with resources, and criticized him for wasting worker hours chasing mosquitoes and wasting material for fumigation programs and screening buildings. General George Davis, Governor of the Canal Zone, who professed great friendship for Gorgas, tried to "set him right," to get these wild ideas out of his head. Gorgas repeatedly sent urgent cables for supplies and material. Walker answered evasively if at all and told Gorgas by return cable that cables were too costly; use the mail.

This commission ruled from Washington DC and rarely visited Panama for fear of Yellow Fever. No one on the commission had ever organized a giant construction project, nor were they accustomed to dealing with the massive supply and labor problems. None had medical training, and they considered the canal solely as a problem of engineering. Scrupulously honest, Walker was convinced that corruption was the only cause of the French failure. He put enormous obstacles in the way of resource requests often not reading requests to fund projects. The American Medical Association (AMA) sent Dr A.L. Reed to Panama on a fact-finding mission. His findings and report of the obstructionist posture of the Walker commission, along with political pressure from the AMA, resulted in the firing of Walker.

Theodore Shonts, the new commissioner, immediately laid the groundwork to replace Gorgas with "a man of more practical view," an unknown Osteopath whose views on disease control agreed with Mr. Shonts. During this time of trial, friends counseled Gorgas to quit. His secretary told he would get so upset he would sweep his papers into his desk drawer and go off a few days to cool off. Nevertheless, his wife described his basic nature as cheerful and he continued to enjoy dinner parties, his friends, and storytelling.

Shonts forwarded his recommendation to replace Gorgas through Taft, Secretary of War. Taft, a friend of Dr A.L. Reed who had just exonerated Gorgas, approved the recommendation and passed it on to President Roosevelt. Roosevelt first sought the advice of Dr W.H. Welch, Dean of Johns Hopkins School of Medicine, and his friend, Dr Alexander Lambert. Welch advised that Gorgas was the most qualified for the job, and Lambert told Roosevelt that the major obstacles to building the Canal were Yellow Fever and Malaria. "Keep Gorgas and give him the proper authority and the Canal will be built," said Lambert.

President Roosevelt rejected the proposal to remove Gorgas and told Shonts to give the doctor his full cooperation. Shonts changed his attitude. Gorgas oversaw the development of two major hospitals in the cities of Colon and Panama and several station hospitals within the Canal Zone interior. He visited patients in the hospital regularly as a clinician, although sanitation was his primary effort. He established a mortality

**Until theres a cure,  
theres the Diabetes Association.**

record, successfully dealt with respiratory diseases due to overcrowding, upgraded a leprosarium, eliminated Yellow Fever, and controlled Malaria. The last case of urban Yellow Fever in Panama occurred in December 1905. Four thousand workers lost their lives during the American era as compared to 22,000 during the French era.

Dr Gorgas continued to have difficulties with engineers. Lt. Colonel G.W. Goethals, described by Marie Gorgas as power hungry, took over as chief engineer. His authoritarian leadership style conflicted with Gorgas' more persuasive manner. Goethals attacked the cost of sanitation, about \$350,000 per year, complaining that sanitation expenses were five percent of the total costs of building the canal. He cut spending and in some cases he was right. In the case of grass cutting he was able to clear more area at less cost. The Yellow Fever control program continued to progress successfully. Gorgas blamed Goethals for incomplete control of Malaria. Goethals, in turn, wrote that Gorgas had done little and the real credit of Yellow Fever and Malaria control should go to Walter Reed and Ronald Ross. Ross had visited the Canal Zone and described Gorgas' campaign as sound in every detail. Goethals also took credit for Yellow Fever control through the accolades of J.G. Hibben, then President of Princeton University. It is difficult to understand why the engineer in charge of such an internationally important project would become involved in a debate about where the medical credits lie. Perhaps it was because of the significance of the infectious disease problems. Achorn, in his *History of European Civilization and Politics Since 1815*, states that the completion of the canal was a "triumph of medicine far more than of engineering skill." Yet it was a great engineering feat.

On completion of the Panama Canal, Gorgas traveled to South Africa to consult on the control of pneumonia in gold miners. While there he learned that President Wilson had appointed him the Surgeon General of the Army. During his tenure as Surgeon General he also served a term as President of the AMA.

In 1916, with the impending war in Europe, Surgeon General Gorgas began to build a strong Medical Reserve Corps. His goal was to establish an environment of "hygienic competence for the American soldier." He enlisted the support of many of the country's most prestigious physicians, such as the Mayo brothers, and established a legacy of excellent medical care. He eliminated the limit of Major as the highest rank Reserve medical officers could attain. From 1916 to June 1918 the Army Medical Department grew from fewer than 1,000 officers to 23,000. Professionals included physicians, dentists, nurses, veterinarians, and sanitation officers. By the end of the war, there were over 32,000 medical officers, 35,000 civilian physicians, 22,000 nurses, and 250,000 enlisted personnel in the Army Medical Department. Hospital beds expanded from 3,843 to well over 100,000 in 92 hospitals in France and the United States. Doctors performed over six million induction exams. Preventive medicine practices included vaccinations, emphasis on exercise, diet, proper clothing, adequate space, proper ventilation of the barracks, and recreational sports. Gorgas was instrumental in devel-

oping the concept of government responsibility to wounded soldiers, which included returning them to a useful and productive civilian life.

Because of the rapid manpower expansion during the war, troops experienced several epidemics of measles and pneumonia. Congress severely criticized the Surgeon General and the Army Medical Department. Gorgas testified before several congressional committees, and these investigations exonerated him as a competent administrator. These hearings established that authorities picked camp sites without medical input and developed living areas without adequate spacing or medical facilities. As a result of these hearings, Congress shifted the blame to the Secretary of War.

Because of his remarkable achievements as Surgeon General, William Gorgas was the first physician to attain the rank of Major General. However, he continued to refer to himself as "Doctor," aligning himself with the physicians in the field and clearly establishing his primary role as an Army doctor.

After retirement from the Army, Gorgas went to Peru and Ecuador to pursue his conquest of Yellow Fever. While visiting London, he suffered a stroke. This illness prevented a scheduled audience with King George the Fifth. The King broke protocol, stating that if Gorgas could not come to him, he would go to Gorgas. On this visit, the King of England elevated Dr Gorgas to Knight Commander of the Most Distinguished Order of St. Michael and St. George. Four weeks later, on July 3, 1920, William Gorgas died and his body was returned to America and interred in Arlington Cemetery.

William C. Gorgas realized his genius in his ability to synthesize the ideas of others into a practical concept that benefited the world community. He was a master of organization and diplomacy who could enlist the cooperation of the of eminent physicians and statesmen. Yet he also stayed in touch with the common man. As Surgeon General, he took time to write to a dying Army private. His career was a testimony to persistence and courage. He was a gentleman with a vigorous joy of life whose self-discipline leadership by example, and persuasiveness led to the control of Yellow Fever, Malaria, and other communicable diseases. He developed Army sanitation and because of him, the American Soldier lives today in the most hygienically sound environment in all of military history.

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